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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/806,202	03/23/2004	Hiroki Yoshikawa	119162	1944

25944 7590 03/27/2007

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EXAMINER	
ROSASCO, STEPHEN D	
ART UNIT	PAPER NUMBER
1756	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/27/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/806,202	YOSHIKAWA ET AL.	
	Examiner	Art Unit	
	Stephen Rosasco	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 March 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3,5,7-12 and 25-34* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3,5,7-12 and 25-34* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *23 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Detailed Action

In response to the Amendment of 3/5/07, wherein claims 2, 4, and 6 were canceled, the examiner withdraws the previous office action rejections, includes a new rejection here over newly cited art over the remaining claims and makes the action Final.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, THIS ACTION IS MADE FINAL. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

REMARKS – claims 9-25 are product by process claims, which for patentability purposes are treated as product claims. The independent claims 1 and 9 have been amended to include the limitation that the mask blank has at least two phase shift films formed. The additional reference here to Isao et al. is to address this added limitation.

The applicant argues that independent claim 9, from which claims 10-25 depend, recites "two or more shift films," and "further, each phase shift film is formed by continuously discharging targets used for forming any one of the layers of the phase shift films without shutdown even when the other layers of the phase shift films are formed, and a composition ratio of metal and silicon in the phase shift film is changed by adjusting discharge powers applied to each target." Independent claim 1 includes similar limitations. As discussed above, Angelopoulos nowhere teaches or suggests these claimed features, nor is there any suggestion or motivation to modify Angelopolous in order to obtain the claimed features. Further, neither Miyamura nor Mitsui remedy Angelopoulos' deficiencies.

The examiner disagrees in that in the rejection below the following teaching of Angelopoulos -Variation in composition of the composite targets or individual variation of power and deposition time of the pure targets produces changes in film composition.

Also with the claim as written it would seem intuitively obvious that if the power to the silicon target is changed compared to the power to the metal containing target then there will less metal deposited.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1,3,5,7-12 and 25-34 are rejected under 35 U.S.C. 103(a) as being unpatentable Isao et al. (6,569,577) in view of Angelopoulos et al. (6,858,357) , Miyamura et al. (6,635,155) and Mitsui et al. (6,153,341).

The claimed invention is directed to a method of producing a phase shift mask blank wherein the method includes at least a step of forming one or more phase shift film on a substrate, and in the step, the phase shift film is formed by the sputtering method by simultaneously discharging at least one or more silicon target and one or more target selected from the group consisting of a metal silicide, a metal silicide oxide, a metal silicide nitride, a metal silicide oxide nitride, a metal silicide oxide carbide, a metal silicide nitride carbide, and a metal silicide oxide nitride carbide.

And wherein a composition ratio of metal and silicon in the phase shift film is changed by adjusting discharge powers applied to each target.

Isao et al. teach (see claims 13-14) a phase-shift photo mask blank comprising a half-tone phase-shift film, wherein the half-tone phase-shift film has a phase difference (Ps) of from 170 to 190 degrees at an exposure wavelength of lambda, and *wherein the half-tone phase-shift film consists of at least four layers* and refractive index of an upper most layer of the film is smaller than that of a layer immediately below the upper most layer.

And wherein the half tone phase-shift film is a *MoSiON* type film.

Claims 13-34 Angelopoulos et al. (see especially claims 1-35, and col. 3, lines 56+) teach that the initial thin film can be deposited by sputter deposition (RF, DC magnetron, AC magnetron, pulsed bipolar DC magnetron, RF diode sputtering, or other sputter deposition methods familiar to those skilled in the art) from either a single target of a composite material (Si.sub.1-x Ti.sub.x, with x in the range 0.01 to 0.5) or two or more targets of different compositions (for example, Si.sub.3 N.sub.4 and Ti targets, or Si.sub.1-x Ti.sub.x and Ti targets). Variation in composition of the composite targets or individual variation of power and deposition time of the pure targets produces changes in film composition. Reactive sputtering with nitrogen and oxygen provides further capability to adjust the relative compositions of Si, Ti, and N and O, and thus the optical characteristics of the film. The substrate stage can be either stationary or planetary for the single target, and planetary for the multitarget with rotation speed adjusted accordingly.

And wherein the sputter target is made of a mixture of metal silicide and silicon.

Claims 5 and 7 are taught (col. 3, lines 55+) · Reactive sputtering with nitrogen and oxygen provides further capability to adjust the relative compositions of Si, Ti, and N and O, and thus the optical characteristics of the film. The substrate stage can be either stationary or planetary for the single target, and planetary for the multitarget with rotation speed adjusted accordingly.

Angelopoulos et al. also teach that by adjusting the oxygen to nitrogen, transmission as high as 20% can be achieved at 193 nm for film thickness corresponding to 180 degree phase shift. Such wide transmission window provides the possibility of extending the operation wavelength down to 157 nm. FIG. 9 summarizes the film deposition conditions, optical properties (% T at 180 degree phase shift, n, and k), and the resulting composition obtained from RBS analysis.

The teachings of Angelopoulos et al. differ from those of the applicant in that the applicant teaches in claims 2, 4, 6, that the composition ratio of metal and silicon in the phase shift film is changed by adjusting discharge powers applied to each target; and in claims 3 and 7, that molybdenum is used as the metal in the target, and that a center value of a distribution of phase differences in the phase shift film to wavelength of light used in exposure is 180+-10 degrees, and a center value of a distribution of transmittances in the phase shift film is 3-40%.

Miyamura et al. (col. 4, line 56 to col. 7); a method for forming an optical thin film having multiple optical layers on the surface of a substrate using a magnetron sputtering apparatus with a sputtering chamber having cathodes, the substrate, and at least two kinds of targets disposed therein.

Miyamura et al. also teach that by *controlling the discharge powers* to be supplied to the respective targets for simultaneous sputtering or the flow rates of the inert gas and the reactive gas, it is possible to form an optical thin film having the desired composition of each layer which have the desired optical constant.

And when a layer of a composite compound, such as a double oxide layer, a double nitride layer, a double boride layer, a double carbide layer, a silicon nitride layer or a boron nitride layer, is to be formed as an optical layer, in order to form such a composite compound layer, two or more targets made of different materials corresponding to formation of such a layer, may be used to carry out sputtering simultaneously.

In such a case, by adjusting the distribution ratio of discharge powers among the plurality of targets, an optical layer having the desired composition and optical constant can be formed with good precision. Also in such a case, in the vicinity of the end point for formation of the optical layer, the layer forming speed may be slowed down by reducing the entire discharge power without changing the power ratio supplied to the targets, whereby the layer thickness can be controlled with high precision.

Claims 3 and 7 are taught by - Mitsui et al. (see col. 8, line 15+) a light translucent film made of a molybdenum silicon nitride (MoSiN system material) thin film was formed on a surface of a transparent substrate. This was for a phase shift mask blank for a KrF excimer laser (wavelength 248 nanometers). More specifically, using a mixing target (Mo:Si=30:70 mol %) of molybdenum (Mo) and silicon (Si), a molybdenum silicon nitride (MoSiN) thin film, whose thickness was 855 angstroms, was formed on the transparent substrate by reactive sputtering in a mixture gas atmosphere (Ar 10%, N.sub.2 90%, pressure 1.5.times.10.sup.-3 Torr) of Argon (Ar) and nitrogen (N.sub.2). The light transmission rate of the obtained phase shift mask blank at a wavelength of 248 nanometers was 2 percent. The phase shift amount (phase angle) f was about 180 degrees.

It would have been obvious to one having ordinary skill in the art to take the teachings of Isao et al. and combine them with the teachings of Angelopoulos et al. and Miyamura et al. and Mitsui et al. in order to make the claimed invention because the advantages of the materials and method modifications are well known in the art, as is the dependence of optical transmission on film material composition and thickness, and it would have been obvious to one in the art to adjust the film thickness to give the desired phase shift and optical transmission as that of claims 13-34.

Conclusion

Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Stephen Rosasco whose telephone number is (571) 272-1389. The Examiner can normally be reached Monday-Friday, from 8:00 AM to 4:30 PM. The Examiner's supervisor, Mark Huff, can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

S. Rosasco
Primary Examiner
Art Unit 1756

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03/22/07